ARNOLD ARBORETUM
HARVARD UNIVERSITY

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FLORICULTURE

INSECT CONTROL AT THE ARNOLD ARBORETUM

IT is the purpose of this article to give a practical summary of the problems in relation to insects effecting trees and shrubs, reporting methods of control that are used at the Arnold Arboretum. Though other materials and methods might give just as satisfactory results, only those will be reported which have been used over a period of years in the Arboretum and have proved satisfactory.

Considerable thought should be given as to the right kind of equipment used in the spraying of trees in parks or private estates. Here at the Arboretum we find that a 300 gallon sprayer, mounted on skids, with a 32 horse power motor that is capable of throwing a stream 80 feet with 350 pounds pressure, is very satisfactory. This sprayer, weighing 1620 pounds, can be loaded on a 1½ ton truck in a very few minutes from a platform. When not in use the truck is available for other work.

Our first problems are the **scale insects.** There are several kinds of these which do damage to shrubs, fruit and shade trees; namely, oyster-shell scale, San José scale, scurfy scale, evonymus scale, pine leaf scale that also affects spruces, and juniper scale. All of these scale insects obtain their food by sucking out the plant juices from the twigs and limbs, thus materially weakening the plant. Oyster shell, San José and scurfy scale may be found on apples, lilacs, plums, peaches, poplars and willows. They can be controlled by spraying with miscible oil, 1 gallon of oil to 15 gallons of water. Or lime sulphur may be used but, though it gives good control, it is being discontinued on ornamentals because of the bad color it leaves and because it is disagreeable to use. Spraying with oil for scale insects can be done from February 15 to early April, as weather permits when the temperature is not below 35° F.

Evonymus scale is similar in shape to oyster shell scale and is the most serious pest of *Evonymus*, often killing entire branches. There are at least two generations of these insects a year. Spray with miscible oil (1 to 30) in the dormant season and again in summer when young scales have hatched (1 to 50). If the plants are badly infested a third spray may be necessary later. It is important to have the dormant spray weaker than for other scale insects, on account of evergreen foliage of *Evonymus radicans* and its varieties.

Considerable damage is done to pines and spruces by the **pine-leaf scale** which is easily recognized because it gives the trees a whitish appearance. Spray with miscible oil early in April, 1 part oil to 30 parts water.

Spruce-gall aphids can be easily recognized by pineapple-shaped galls on new growth of spruce trees, native and foreign. These gall growths are caused by small whitish plant lice feeding at the base of the leaves of young shoots. In August these galls become yellowish, dry and open, and the winged lice escape. Spraying in early spring before the new growth starts (about the middle of April) with miscible oil, 1 part miscible oil to 30 parts of water, will aid materially in controlling this pest.

The work of the **larch case-bearer** is easily recognized by the leaves of the larch turning yellow or brown in early spring. This injury is caused by the feeding of a brown, black-headed caterpillar about $\frac{1}{4}$ inch long, first biting a hole (in the leaf) and then mining in the leaf. The caterpillar is enclosed in a small, grayish case. The young larvae at first mine in the larch leaf; later, this is cut off and serves as a case for the larvae. The winter is passed in the larval stage inside the case. We have found that early spring spraying with arsenate of lead, 2 pounds to 50 gallons of water when the young are feeding is an excellent method of control.

Golden oak scale is one of the most destructive scales occurring on oaks. It can be easily detected as the scale is a beautiful, greenish golden color, and often kills twigs and entire branches. The scales pass the winter as almost mature individuals, the young emerging in May. The pest may be controlled by spraying in very early spring with miscible oil, 1 gallon to 15 of water.

From the end of April to the middle of May, as new leaves appear, close watch should be given to **canker-worms.** As soon as they appear spray should be applied at once as they cause considerable damage in only a few days. There are two common kinds of canker-worms, one appearing in the spring, the other in the fall. The spring canker-worm seems to be the most injurious. It attacks maples, elms, oaks, apples and many other fruit and shade trees. The worms themselves are yellowish brown, about 1 inch long when fully grown. When crawling they arch the middle of their body, being a typical "measuring worm." Spray should be applied when the worms are half grown, using arsenate of lead, 2 pounds to 50 gallons of water.

In the past few years the **willow leaf-beetle** has been giving us considerable trouble. The beetle is a metallic blue in color, oval and rounded, about ⅛ of an inch long. There are two broods a year. It passes the winter under the rough bark of willow trees. Spray early in June with arsenate of lead, 2 pounds to 50 gallons of water. Great importance should be placed on getting the spray on the **under surface** of leaves, as the beetle feeds *only* on that surface. It is frequently so prevalent that it destroys all the foliage on certain species of willows.

Rhododendron lace-bug. The lace-bug does considerable damage every year to Rhododendrons and mountain laurels, producing unsightly yellowish or brown spotting of the leaves, particularly on those in the full sun. It is a flat bug with light, lacy-like wings. The insect overwinters in the egg stage along the midrib on the under side of leaf. These eggs hatch in the early part of May. There is also a second brood in August. Spraying with miscible oil, 1 to 70, as soon as they hatch will control the early brood. The under surface of the foliage should be sprayed very thoroughly, using Sunoco oil at the rate of 1 to 60, for the August brood does the most damage. Select a partly cloudy day with temperature not above 80° F. to prevent the burning of foliage.

The **elm leaf-beetle** is one of the most destructive insects attacking elms. The beetles are about ¼ of an inch long, yellowish green in color with a distinctly darker stripe along each side of the wing cases. The beetles pass the winter hidden under rough bark and various other types of shelters. In the spring they lay their eggs on the under surface of the leaves of elms. The larvae, hatching from these eggs, feed on the under surface of the leaf and practically skeletonize it. Spraying in early June, or as the larvae appear, with arsenate of lead, 3 pounds to 50 gallons of water will control the beetle. This spray should be directed especially to the underside of the leaves. As there are two generations a year, a second spray is necessary by the middle of July.

Rusty colored evergreens in summer often indicate **red spider** injury. These pests multiply very rapidly during hot, dry weather. They can be controlled by spraying with Sunoco oil, 1 gallon to 100 gallons of water, on a partly cloudy day with the temperature not over 80° F. We obtain best results in applying this as a very fine misty spray, using considerable force.

White pine weevil has caused considerable damage to young white pines in the Arboretum. It is easily determined by the central or terminal leader wilting and turning brown. As this damage is caused by grubs within the wood it is very hard to control. Cut out brown leaders and shoots at least several inches below the point where browning first occurs.

There are several **borers** that cause considerable damage to shade and fruit trees. Round-headed and flat-headed apple tree borers have long been a problem on fruit trees. The work of these borers is indicated by shallow burrows on the main trunk just under the bark. Some are noticeable in the spring by the fresh dust or burrow excavations on the trunk. The most effective way of controlling these grubs at the Arboretum has been to cut them out with a sharp pointed knife.

Leopard moth attacks a number of our valuable shade trees such as elms, maples, and lindens. These insects take 2 or 3 years to develop, so that two or three winters are passed in the larval stage. Young trees should be watched as borers get into the main stem. When a hole is located the grub can usually be hooked out with a wire. If this is not successful, put a few drops of carbon bisulphide into the hole and then putty up the opening.

Again we repeat that these control methods are the ones which are actually being used successfully at the Arboretum and have been for several years. However, there are other materials and possible other methods of control which would probably prove just as satisfactory.

L. V. Schmitt

NOTE. In all cases where miscible oil is recommended in this bulletin, such recommendations have been based on Sunoco oil only, which has proved satisfactory at the Arboretum.

There are several books and bulletins available as references for problems dealing with insects or diseases. A few of the outstanding ones might be:

Britton, W.E. Plant pest handbook for Connecticut. i. Insects. New Haven. 1933. Connecticut agricultural experiment station. Bulletin, 344.

Chambers, E. L. and Thompson, N. F. Pests and diseases of trees and shrubs. Madison. 1933. Wisconsin department of agriculture and markets. Bulletin, 145.

Clinton, G.P. Plant pest handbook for Connecticut. ii. Diseases and injuries. New Haven. 1934. Connecticut agricultural experiment station. Bulletin, 358.

Felt, E. P. and Rankin, W. H. Insects and diseases of ornamental trees and shrubs. New York. 1932. Macmillan Company.

Herrick, G. W. Insect enemies of shade trees. Ithaca. 1935. Comstock Publishing Company.

Wilson, Andrew. Insects and their control. New Brunswick, N. J. 1929. Thatcher-Anderson Company.

SPRAY PROGRAM AT THE ARNOLD ARBORETUM

	Spray Material	Amount to Apply	When to Apply
Scale insects	Miscible oil	1–15	Feb. 15 to early April
Evonymus scale	“ “	1–30	when plants are dormant
		1–50	in the summer
Pine-leaf scale	“ “	1–30	early April
Spruce-gall aphids	“ “	1–30	April 15
Larch case-bearer	Arsenate of lead	2 lbs.-50 gal.	when young are feeding
Golden oak scale	Miscible oil	1–15	early spring
Spring canker-worm	Arsenate of lead	2 lbs.-50 gal.	as soon as young appear
Willow leaf beetle	“ “ “	2 lbs.-50 gal.	early June, applied to under surface of the leaves
Lace-bug of Rhododendrons	Sunoco oil	1–70	as they hatch in the spring
		1–60	in August on a partly cloudy day when the temperature is not over 80°F.
Elm leaf-beetle	Arsenate of lead	3 lbs.-50 gal.	early June. A second spray may be necessary for a second brood
Red spider on evergreens	Sunoco oil	1–100	applied in summer as a fine mist on a cloudy day when temperature is not over 80° F.
White pine weevil			cut out borers and dead branches
Borers			dig out

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